FLIGHT

The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:—

Sept. 23....	**Gordon Bennett Balloon Race, Belgium**
Sept. 28....	**Schneider Cup Seaplane Race at Cowes**
Oct. 4	**R.Ae.S. Inaugural Lecture**
Oct. 8–13	**Light 'Plane and Glider Competitions, Lympne**
Oct. 12	**"Some Aspects of an Attempt to Fly Round the World," by Maj. W. T. Blake, before I.Ae.E.**
Oct. 14	**Beaumont Cup Race at Istres, France**
Oct. 18	**"The Manœuvres of Inverted Flight," by Sq.-Leader R. M. Hill, before R.Ae.S.**
Oct 26	**"Three-Ply in Aircraft Construction," by Capt. R. N. Liptrot, B.A., before I.Ae.E.**
Nov. 1	**"Present Developments in Aircraft Instruments," by Major Wimperis, before R.Ae.S.**
Nov. 9	**"Soaring Flight," by Dr. E. H. Hankin, before I.Ae.E.**
Nov. 15	**"The Thermodynamics of Aircraft Engines," by Mr. H. R. Ricardo, before R.Ae.S.**
Nov. 29	**"Airmanship at Sea," by Sqd.-Ldr. Maycock**
Nov. 30	**"The Result of Twelve Years' Welded Tube Construction and the Development of Cantilever Wings," by A. H. G. Fokker, before, I.Ae.E.**

EDITORIAL COMMENT.

IT is becoming increasingly evident that, broadly speaking, but two things are required to make flying as reliable and safe as are other means of transport. The one thing required above all else is absolute engine reliability, and the other is controllability at all speeds, even at speeds below the stalling speed of a machine. There are numerous other problems, certainly, but we are quite convinced that if the absolute confidence of the public can be established and maintained, the resulting amount of traffic will enable those other problems to be solved in due course. When we say the absolute confidence of the public, we mean confidence to such an extent that travelling by air and sending goods and mails by air will be done as a matter of course, and with no more wonder and speculation than in the case of travelling or sending goods and mails by train or steamer. That confidence can be established only after a long period of freedom from accident, and in this connection the daily press could do a vast amount of good if it could be persuaded to point out whenever an accident happens to a military or racing machine that these are no more comparable with a commercial aeroplane than is a submarine with a liner, or a racing car on Brooklands track with a London omnibus. Once the public has been brought to view commercial aviation in this perspective, confidence will follow as a matter of course. Until that confidence has been established nothing that the aircraft designer and the aircraft-operating firm can do will result in attaining for commercial aviation that extensive use which alone can make aviation a paying proposition.

Safety in Flying

The question then arises: How are we to attain the necessary engine reliability? In modern times the reliability of an aero engine is mainly dependent upon engine accessories and engine installation, rather than upon the engine itself, which has now reached a stage where it is very unusual for any part of the engine proper to fail. Ignition and petrol systems appear to be the worst offenders, particularly the latter, but with the method of using direct-gravity feed from the main tanks which is now becoming

almost universally adopted, and leading the fuel through flexible petrol-proof tubes, there is every reason to hope that petrol system troubles will soon be a thing of the past.

It may be accepted that absolute engine reliability will never be attained, and cannot be attained; but a reliability which is absolute to all practical purposes may be hoped for. In this connection it is not without interest to refer to opinions expressed in two papers read before the International Air Congress, and extracts of which are published elsewhere in this issue. Handley Page and Savage in their paper advocate the three-engined machine as offering greater immunity from total engine failure, and J. D. North gives, in an appendix to his paper, methods of calculating the relative chances of a forced landing with single, twin, three and four-engined machines. Mr. North arrives at the result that when half of the available power will fly the machine the twin is better than the three-engined machine, but that when more than one-half of the total power is required the three-engined machine will be the less liable to forced landings. According to Mr. North, if the chance of total failure in one engine is 1 in 20, *i.e.*, 95 per cent. reliability, the chances of a forced landing are, roughly, 1 in 10 for the twin-engined machine and 1 in 140 for a three-engined machine. In other words, the three-engined machine is 14 times as reliable. If the chances of total failure of one engine is 1 in 100 the three-engined machine is, roughly, 67 times as reliable as the twin. These figures are based upon the assumption that flight is impossible with a single engine running.

Thus it may be admitted that, although the three-engined machine is probably not as efficient as the single-engined or twin-engined, its greater reliability cannot be doubted, especially in view of the fact that it is scarcely likely that it will be a commercial proposition to run a machine which is capable of flying on one of the engines with which it is fitted. Thus the case for the three-engined machine seems to have been proved, and the reason for the present non-existence of a British machine of this type may be ascribed to the fact that there is not yet sufficient demand for passenger accommodation to justify running a machine so large as to take three of the power units at present in use. With the coming of longer routes, however, it may be hoped that the three-engined type of machine may be given a thorough test under actual working conditions, and it should then be possible to establish definitely and in practice whether figures based upon theory are correct.

The second desideratum to which we referred, *i.e.*, controllability at all speeds, even below stalling speeds, is a subject that is receiving the most careful attention, and research and experiment seem to indicate that this problem may be capable of solution. If that should prove to be so we shall have gone a long way towards a degree of safety which will compare favourably with that of train and steamer and exceed that of travel by motor vehicles.

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Long Distance Aircraft

Accepting as proved—at least theoretically—by the figures and opinions given in the two extremely interesting papers published this week, the fact that for reliability coupled with economy the three-engined commercial machine is the type which offers the greatest prospects of freedom from breakdown due to engine failure, the question arises how to make the best use of such a reliable type. In this connection it is interesting to recall that the specifications for three new commercial types of aeroplane have recently been issued by the Air Ministry, and that at least one of these is required to have a range of 1,300 miles, cruising at 90 m.p.h.

Without wishing to go into detailed criticism of the specifications sent out by the Air Ministry, we may say that to us it appears that by the time such a machine is loaded up with fuel for the range required and with a large crew there will be but little lift left for paying load, quite apart from the fact that to maintain such large crew on each machine would be a serious drain on the financial resources of an operating company. It is obvious that the larger the paying load that can be carried the less important becomes the crew of a given size. If, therefore, the machine contemplated is to be a commercial proposition, and a large crew is considered essential, while the range must be 1,300 miles, it would seem that, as far as can be seen at present, there is but one way of attaining economy, *i.e.*, to reduce the amount of fuel carried.

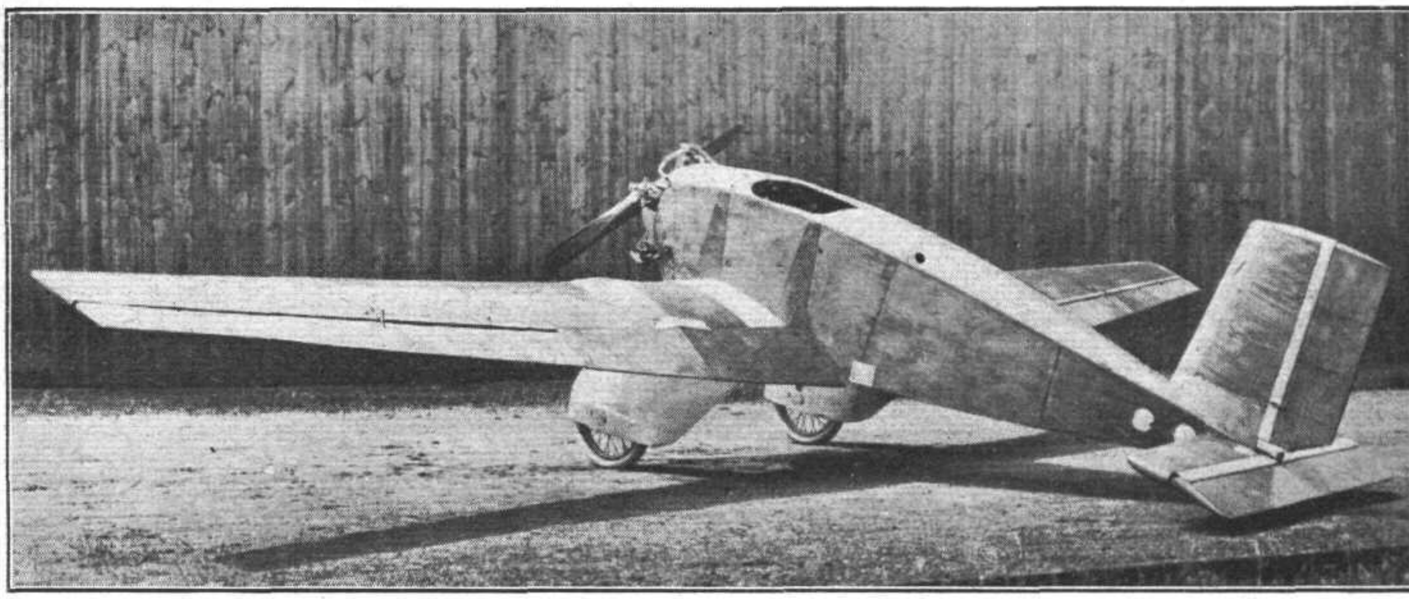
Let us suppose that the machine contemplated is fitted with three engines of 600 h.p. each when throttled down to a cruising speed of 90 m.p.h., and that their consumption is ½ lb. of petrol per h.p. per hour (which is a low figure to take). The petrol consumption per hour will then be 900 lbs., and, as the journey of 1,300 miles will take 14½ hours, the amount of petrol carried, without allowing any excess for emergencies, will be 13,000 lbs., or 7·2 lbs./h.p. for petrol alone. If, now, this amount could be reduced to one-fourth, or about 3,250 lbs., there would be available a further paying load of 9,750 lbs., which is equivalent to about 40 passengers and luggage.

Frankly, we fail to see how a machine carrying fuel for such a long non-stop flight could ever be made to pay, and if these long stages are necessary it will be imperative to find means of cutting down the quantity of fuel carried at any given time. The recent duration flight made in America demonstrated, for the second time during the last few months, the feasibility of refuelling during flight, and although we would not go as far as to claim that this operation has yet reached a stage where it can be considered to be commercially possible, we do think that sufficient has been proved to demonstrate that the rest is only a matter of development. We do most seriously urge that experiments on these lines be initiated in this country, so that by the time we get going with our long-distance air lines the problem of refuelling during flight may have been reduced to an everyday manœuvre presenting no special difficulties. In his paper Mr. J. D. North calls attention to the subject, and it should be remembered that this paper was written before the recent American performance, which has thus in a most striking manner proved the views of Mr. North correct.

The problem is one which concerns the Royal Air Force as much as it does commercial aviation, and we think the initial experimental work might very well be undertaken by the R.A.F. who should have available several types of machines suitable for the purpose. For instance, certain twin-engined machines capable of flying on one engine only should have the reliability necessary for prolonged flight, and should be capable of providing useful data on several subjects other than the transfer of fuel.

THE ALBATROS SPORTING TYPES L.59 AND L.60

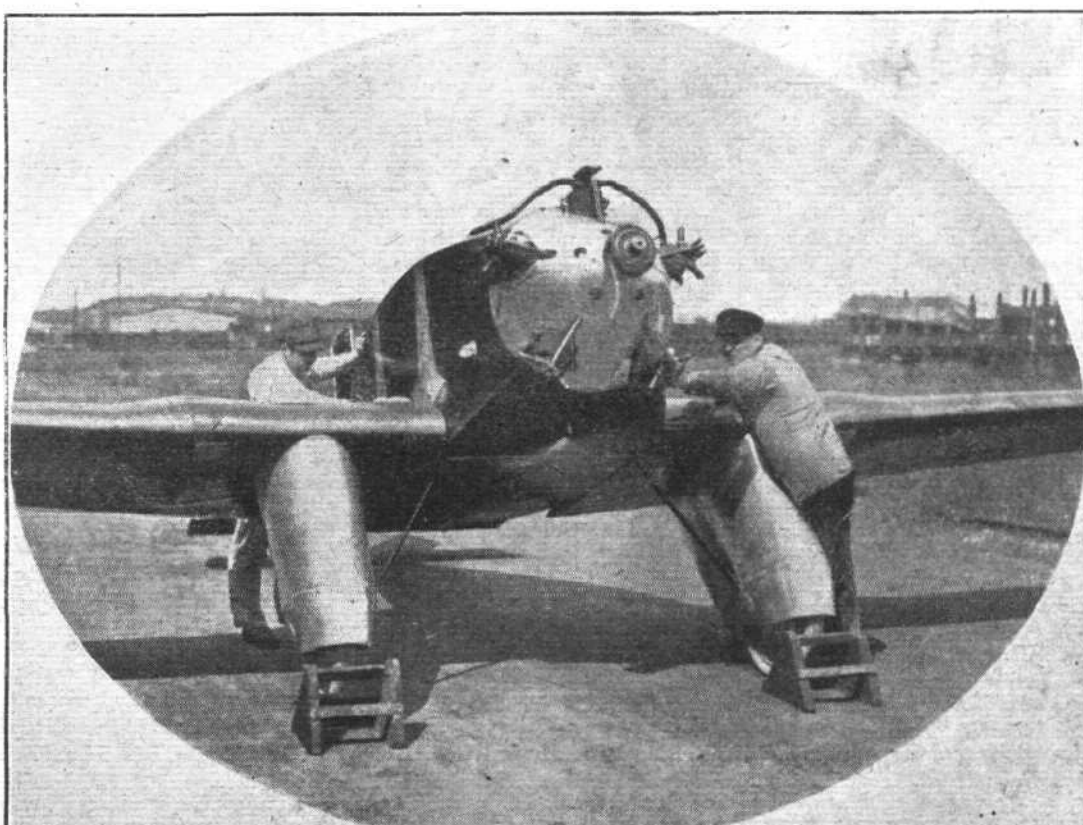
AMONG the firms who were to have exhibited machines at the Gothenburg International Aero Exhibition was the Albatros-werke A.G., of Berlin-Johannisthal. Unfortunately, complications over which the firm had no control prevented the machines from being sent, and thus I.L.U.G. was deprived of at least two interesting machines. One of the Albatros machines that were to have been shown was the type L.58 monoplane passenger carrier, but as this was described and illustrated in FLIGHT on October 12, 1922, we have thought that a reference to the other type which had been got ready for the exhibition would be of more interest.



THE ALBATROS SPORT 'PLANE: Three-quarter rear view

The Albatros sporting type is produced in two slightly dissimilar models: one, known as the type L.59, is a single-seater, with 50-60 h.p. Siemens radial engine, and the other is a two-seater, with a 90-100 h.p. engine of the same make, its series number being L.60. The two models are, generally speaking, of the same outline design, but certain differences arise out of the fact that the one has an extra seat and a larger engine. The machine illustrated in the accompanying photographs is the single-seater, type L.59, but the following description, except when otherwise stated, refers to both models.

Reference has been made in FLIGHT to the effect which Inter-Allied restrictions on German aircraft production has had on modern German design. Debarred from constructing large machines, or, more correctly, machines with powerful engines, German designers have been obliged to design for aerodynamic efficiency, so as to attempt to improve this to the point where the smaller engine will give the same performance. Although this is no easy task, and cannot be said to have been quite accomplished, there is no doubt the several German aeroplanes of recent date do show evidence of a serious endeavour to get away from stagnation in design. In most cases the line of development appears to have been the elimination of all avoidable head resistance, such as struts, bracing wires, etc. In some German types, in fact in most, the result has been a cantilever monoplane, although the Caspar U.I exhibited at Gothenburg provides an example of the pure cantilever biplane. Some of the German designers favour the high wing position, others the low. The Albatros



The Albatros Sport 'Plane: View of nose, showing engine cowling, "trousers," etc.

sporting types belong to the latter class, or "Tiefdeckers," as they call them. Although slightly less efficient aerodynamically than the "high-decker," the low wing position has certain structural advantages that help to counteract the slightly lower efficiency. Also, the low position of the wing facilitates undercarriage design in that the tips of the wings are closer to the ground and should thus help to prevent overturning. In a monoplane with the wing resting on top of the fuselage a very wide wheel track seems to be called for, and it is almost useless to fit wing tip skids, as the machine would heel over so far as to cause the wing tip to touch at a sharp angle. In the Albatros sporting type the designers have gone one step further, and have mounted the undercarriage not on the fuselage at all, but on the wing roots. This arrangement has obviously been chosen because not only does a wide wheel track result, but, owing to the fact that the undercarriage members are vertical, the wheels can be partly enclosed in the streamline fairing surrounding each "leg." These "trousers" are well shown in one of the accompanying photographs.

The wing is constructed entirely in wood, and is planked with three-ply. In order to facilitate transport it is built in three sections, the centre section remaining in place and carrying the undercarriage. The wing is a pure cantilever, there being no external bracing whatever.

In the fuselage the usual Albatros construction has been employed. It may be recollected that in 1914 an Albatros biplane was flown in this country by Herr Robert Thelen, and that already in those days the Albatros designers favoured the all-wood fuselage, consisting of a light skeleton of formers and longerons, covered with thin three-ply wood. The same construction characterises the latest Albatros monoplanes, and certainly appears to have the advantage of keeping its shape without the attention required by the wire-braced type.

The Siemens radial air-cooled engine is neatly cowled-in, and is supplied with petrol from a tank mounted under the pilot's cockpit, inside the wing root. Sufficient fuel is carried for a flight of 3½ hours' duration at full power.

The type L.59 is, as already mentioned, fitted with a 60 h.p. engine, and the L.60 with a 90-100 h.p. Siemens. The total loaded weight of the L.59 is 480 kgs. (1,060 lbs.), the load carried consisting of pilot, 75 kgs. (165 lbs.), and 3½ hours' fuel (125 lbs.). In the case of the L.60 the total loaded weight is 600 kgs. (1,320 lbs.), and the useful load consists of pilot, passenger, and 81 kgs. (180 lbs.) of petrol. The L.59 has a maximum speed at 3,300 ft. of 140 km. (87 m.p.h.) and the L.60 does 145 km. (93 m.p.h.) at the same altitude. The climb to 1,000 m. (3,300 ft.) occupies 9 mins. in the case of L.59, and 8 mins. for the L.60. No figures relating to landing speed are available. The overall dimensions of both types are: Length, o.a., 5·4 m. (17 ft. 9 ins.); span, 10·3 m. (33 ft. 10 ins.); height, 2·65 m. (8 ft. 8 ins.).

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

GLIDING COMMITTEE

A MEETING of the Gliding Committee was held on Wednesday, August 29, 1923, when there were present: Lieut.-Col. M. O. Darby, in the Chair, Lieut.-Col. W. A. Bristow, Mr. E. C. Gordon England, Mr. C. R. Fairey, Major O. T. Gnosspelius, Lieut.-Col. F. K. McClean, A.F.C., Mr. W. O. Manning, Lieut.-Col. A. Ogilvie, C.B.E., Capt. W. H. Sayers, and the Secretary.

Course.—The circuit over which all the competitions will be flown is 16⅞ miles. The circuit will have three turning points, viz.: Summerhouse Hill, New Barn Farm, Lympne Aerodrome.

Additional Prizes.—Correspondence between the Club and Society of Motor Manufacturers and Traders and the British Cycle and Motor-Cycle Manufacturers and Traders Union was considered, and it was decided that the prizes of £150 each offered by these two societies should be awarded as one prize. Competitors must be British subjects, and the machine and engine must have been entirely constructed in the British Empire. The same machine and engine must be used throughout. The prize of £300 to be awarded for the largest number of completed circuits of the course, with a minimum of 400 miles, made during the period of the competitions.

The Abdulla £500 Prize.—It was decided that the distance for the speed contest for the Abdulla Prize should be approximately 30 miles. Competitors must pass the Transport Test and complete at least one lap of the course in the competitions for the prizes offered by the Duke of Sutherland or the *Daily Mail* before competing for this prize.

Arising out of various correspondence the Committee made the following decisions:—

Transport Test.—The overall width of the machine when transported must not exceed 7 ft. 6 ins.

There is no limitation to the number of persons engaged in dismantling the machine, but not more than two persons will be allowed for transporting the machine. The time occupied in dismantling the machines will be included in the three hours allowed for the Transport Test. Any parts used in the Transport Test must be carried in the machine when flying in the competition.

Machines must be presented to the Officials fully erected before being dismantled for the Transport Test.

Certificates of Airworthiness.—The Air Ministry has agreed to waive Certificates of Airworthiness and Registration for machines taking part in the competitions.

Accommodation.—Accommodation for machines will be available at Lympne Aerodrome, near Hythe, from Wednesday, October 3, 1923. They will be housed free of charge.

Entries.—Entries close October 1, 1923. The entry fee is £5. This fee, together with entry form, must be sent to the Royal Aero Club, 3, Clifford Street, London, W. 1.

RACING COMMITTEE

A Meeting of the Racing Committee was held on Wednesday, September 5, 1923, when there were present: Major-General Sir W. S. Brancker, K.C.B., in the Chair, Lieut.-Col. W. A. Bristow, Capt. R. J. Goodman Crouch, Lieut.-Col. M. O. Darby, Lieut.-Col. F. K. McClean, A.F.C., Mr. W. O. Manning, Lieut.-Col. A. Ogilvie, C.B.E., and the Secretary.

Schneider International Seaplane Race.—The Committee after carefully considering the organisation came to the following decisions:—

Course

The turning points at Cowes: Two Mark Boats anchored about 300 yards from the Victoria Pier, Cowes.

The turning point at Selsey: White Cross on the ground, in close proximity to the Windmill.

The turning point at Southsea: Mark Boat anchored off the South Parade Pier.

The Headquarters for Officials during the Race: Pier Head, Victoria Pier, Cowes.

Officials

The following Officials were appointed:—Clerk of the Course: Lieut.-Col. M. O. Darby.

Marshals:—

Lieut.-Col. A. Ogilvie, C.B.E., for America.

Capt. R. J. Goodman Crouch, for France.

D. C. MacLachlan, for Italy.

Capt. L. T. G. Mansell, for Great Britain.

Press Steward: Brig.-General F. L. Festing, C.B., C.M.G.

Offices: **THE ROYAL AERO CLUB,**
3, CLIFFORD STREET, LONDON, W. 1.
H. E. PERRIN, Secretary.

Trial Flight of Z.R.1

ON September 11 the giant rigid airship Z.R.1, which has been built at Lakehurst, New Jersey, U.S.A., made her first trial flight. Leaving her shed at Lakehurst, the airship steered a course for New York City, nearly 100 miles away. The great airship circled over the city, escorted by a squadron of aeroplanes, and her appearance was greeted with enthusiam by thousands of spectators who had collected on the flat roofs of the New York skyscrapers. Passing the Statue of Liberty the Z.R.1 dipped her flag and then proceeded to Philadelphia, whence she returned to her shed at Lakehurst, N.J. No attempt was made to drive the ship at full speed, a comfortable cruising speed of about 50 m.p.h. being maintained with the engines throttled down.

PAPERS AT THE INTERNATIONAL AIR CONGRESS

The Technical Development of the Aeroplane

BY J. D. NORTH

[THE paper read by Mr. J. D. North, Chief Engineer of Boulton and Paul, Ltd., of Norwich, was of more than ordinary interest, and had space permitted we should have liked to publish the paper in full. As this is not possible, we have had to confine ourselves to the following extracts, which will, we hope, be found of sufficient interest to show that the entire paper should be thoroughly investigated. This applies particularly to the very excellent appendices to the paper, notably that in which Mr. North has extended Major Hill's method for determining the value of the figure of merit of parts of an aeroplane to include certain factors which were neglected in R. and M. No. 217.]

Mechanical flight in the brief twenty years of its existence has passed through four phases, each of an approximately equal period, and which are defined sufficiently clearly to be marked by the observer. There are indications that we are now entering on a fifth phase in the art and practice of aviation, the trend of which forms a legitimate field for speculation. The first, which may well be called the pioneer age, was a necessary part of that great scheme of mechanical evolution of which the invention of the thermodynamical prime mover is the most significant feature. Within this period, enduring ridicule of their aspirations and contempt of their achievement, a small band of enthusiasts in America and Europe were concentrating their energies on an endeavour to remain in the air for a sufficiently long period to learn the nature of the problems associated with the flight of the aeroplane. The Wright brothers, leading easily in the race, were the first to discover how to control the attitude of an aeroplane in flight. Once the power of sustained flight had been achieved the practical engineering difficulties were met rapidly, and in 1908 Blériot's flight across the Channel, though by no means the most noteworthy achievement of the pioneer phase, forced its attention on the world at large and on the inhabitants of the Island in particular.

Then came the period of demonstration. People everywhere wished to see and to experience the novelty of human flight, and as spectators, passengers, and donors of prizes the community commenced to contribute its quota to the supply of financial lubricant, for lack of which the wheels of progress had revolved but slowly and laboriously. The vaguely defined possibilities of these new machines as weapons of war could no longer pass unnoticed, and State organisations for the development of the science and art of aviation were provided or enlarged. To these organisations, whatever else may be said of them, must be given a large share of the credit for the development of the technique of the aeroplane at a time when the juvenile aircraft industry could barely afford to consolidate its position by demonstrating to the general public that the conquest of the air had been achieved. The various military competitions, like others of more recent date, if they attained no other object, at least served to demonstrate how difficult it is for the most representative judicial committee to pronounce a judgment which will be endorsed by that inexorable court of appeal, the march of events.

During the period of demonstration the development of the aeroplane was rather along the line of effectiveness than efficiency. When the 50 h.p. Gnome engine was fitted in the 25 Anzani-Blériot a radical departure was made from the "tangent" class of aeroplane, which was so called because the available power curve was very nearly tangential to the curve of power required for flight. Immediately the power of acceleration, the speed range, and consequently the manœuvrability were increased, the climax being reached at the end of this period in the exhibition of looping and other forms of trick flying rendered possible by these means. The war phase which followed ultimately resulted in a struggle for improvement of performance and manœuvrability.

After the Armistice was signed and the war contracts had been liquidated the huge industry and technical organisation which had grown up during the War passed through a phase of attrition, particularly painful as following so closely on the period of expansion from 1915 to 1918. Under the economic conditions then obtaining no genuine commercial development of the aeroplane could take place, and in consequence most of the work of aviation since that period has taken place under national direction, and to some, though by no means so full an extent, at the national expense. Under the pressing necessity for public economy, the funds which have been available for maintaining the aircraft industry and for developing the technique of aviation during this period, have been less than the merits of the case indicated. Those who have undergone this process of attrition may not improperly be said to have had a "thin time," and it is only natural that they should look eagerly for any signs of more generous treatment. They observe that there is apparently an increased public interest in aviation which they hope will be reflected in a more adequate public support, without which aviation can be but a shadow of its real self, and it is proper that they should consider in what direction their activities may best be directed to reap the fullest advantage of the improved circumstances.

Let us take stock of our technical assets. We have, as has already been pointed out, a large amount of incompleted work which requires sifting and developing to its proper conclusion.

We cannot expect to develop the aeroplane on the heroic lines, the achievement-at-any-price methods, which were proper to the war period. Probably we shall be compelled to concern ourselves mostly with small matters out of the multitude of which great things may come. Firstly, there is the development of the aeroplane from the economic standpoint, the improvement of the ratio of the useful load to the gross weight, and the improvement of fineness whereby for given horse-power this gross weight may be given a better performance. These may be attacked either by systematic improvement of detail or more speculatively by radical changes in design. The scope for advance on existing lines may be summarised as follows:—

1. *Reduction of Structure Weight.*—(*a*) *A more accurate knowledge of external forces in flight.*

(*b*) *More reliable methods of stress computation.*

(*c*) *Improvements in structural arrangement.*

(*d*) *Specifically stronger materials.*—Here we have already made a very notable progress in the substitution for timber of steels and alloys of aluminium, and generally in the use of better quality steels. Further substantial advances in this direction are to be expected.

(*e*) *Reduction in overall dimensions.*

2. *Reduction in Weight of the Engine and the Fuel Consumption for a Given Power.*—There do not appear to be great prospects of immediate improvement in engine weight or consumption. The most effective results may be expected from the use of suitable supercharging devices for increasing performance and altitude. Such devices are vitally necessary for military aeroplanes, and have been used successfully in the experimental stages.

So far as fuel consumption is concerned, where very long journeys are involved there is quite a possibility of refueling in flight. It has repeatedly been shown that aeroplanes can establish contact with one another in the air, and should it become necessary in the future, large civil aeroplanes might be refuelled by tankers from stations at suitable short intervals of 200 to 300 miles.

3. *Reduction in Dead Weight.*—That is to say, the weight of the crew and their necessary instruments, etc., in relation to the useful load. At the present time this figure is very high on commercial aeroplanes.

4. *Aerodynamic Improvement.*—In considering the performance for a given power load it is necessary to decide what class of performance is required—rapid transport or power of quick manœuvre. Military aeroplanes may broadly be classified as:—

(1) Aircraft for offensive action against aircraft.

(2) Reconnaissance machines capable of self-defence.

(3) Bombing machines capable of self-defence.

(4) Bombing and Transport machines practically incapable of self-defence.

The first class will depend for its power of offence on manœuvrability, speed and climb, which enable it to bring its armament effectively into action. The necessity for these qualities diminishes gradually from class to class till with the fourth class the conditions are much the same as those required for civil aeroplanes. In the machines which are intended for transport purposes the surface loading is practically controlled by the necessity of rising from and landing on certain types of grounds under reasonably safe conditions. There may, however, in the future be this important distinction between military and civil aircraft, at any rate when the latter are used in civilised countries: that whereas military aeroplanes may be required to land and rise from unprepared ground, it may be that in future air lines will run over a series of flying grounds so arranged as to make possible with safety

landings at a speed which could not be thought of in ordinary cross-country flying as we now understand it. It is in connection with these transport machines that such devices for increasing lift as the slotted wing and the variable trailing flap should prove most useful.

5. *Head Resistance.*—The outstanding item of head resistance which should be reduced is the very large proportion arising from the existing arrangements for cooling the engine, as it is not uncommon for this to represent 20 per cent. of the total resistance of the machine. Improvements are to be expected by increasing the temperature difference between the cooling medium and the atmosphere (*e.g.*, steam cooling) and by the use of aerofoil or similar surfaces as radiators (*e.g.*, tubes arranged round the aerofoil or body surface and conforming to the profile thereof). In the case of air-cooled engines it is necessary to provide a properly controlled and relatively low speed airflow if the resistance is to be kept down. As the drag increases in proportion to the second power of velocity and the dissipated heat as rather less than the first power, the importance of large cooling surfaces with comparatively low velocity air currents will be appreciated. It is unfortunate, of course, that to fulfil such requirements an increase of weight is to be feared, and we shall have to strike a balance between the two conditions.

It has on more than one occasion been pointed out that the maximum lift-drag of an aeroplane is very much worse than that of combination of a good streamline form. This is due to the additions of engine cooling, resistance, drag from stabilising and control surfaces, undercarriage, external wing structure, and the departures from the streamline form of body which are necessary to give adequate view and accommodation to the occupants or to provide a good field of gunfire. In the case of that class of military aeroplane which must fly over any country and must depend on its power of manœuvrability for offensive and defensive action it is very improbable that a nearer approach to the ideal can be obtained; but in the case of transport machines it seems quite likely that considerable refinements can be carried out somewhat on the lines suggested by Prof. Junkers many years ago, namely, to provide all necessary accommodation inside the wing structure and to make that structure complete without external bracing. A little arithmetic will show that to realise these ideas, *i.e.*, wings deep enough for head room, the aeroplane must have a gross weight of about 15 tons, and it would only be possible to construct internally braced planes economically on an aeroplane of such a size by distributing the whole of the load along the span of the wing. This is by no means impracticable, and although it would have the effect of giving the aeroplane a very slow rolling and yawing period, it would not make the machine at all uncontrollable so far as straight-forward flying is concerned.

The problem of undercarriage design for a machine of this size is not very difficult, since the travel of the undercarriage is usually limited by the angular movements of the undercarriage structure, and it is consequently easier to obtain a large absolute deflection on a big aeroplane than on a small one. The most serious trouble is to be expected in providing sufficient wheel surface on ordinary grounds. The ideas that very large aerodromes are necessary for very large aeroplanes is, of course, erroneous, since for a given power and surface loading an aeroplane of any size will leave the ground with the same length of run, and even an aeroplane of this size would be extremely small compared with the length of its run to get off. As a still further refinement the undercarriage, as we now know it, might be dispensed with altogether and the aeroplane launched from a suitable apparatus, a feat which has already been repeatedly accomplished, and which would dispense with the necessity of wheels, one of the principal items in the weight and resistance of an undercarriage.

6. *Reliability and Safety.*—The safety of an aeroplane depends primarily on its ability to keep itself in the air, and to be under control when landing. Increased insurance against forced landings from engine failure can be obtained by a plurality of power plants, provided the aeroplane is capable of flying with suitable fractions of its total power. It seems likely that only the higher-powered military aeroplanes can use the two-engine arrangement with advantage, since only with such machines is it possible to provide at least twice the necessary minimum power for flight, while the three-engined aeroplane seems to be indicated for immediate transport needs.

Lack of control near the stalling speed is still apparently one of the most frequent causes of accidents, and the systematic investigation of this problem which is being undertaken in this country seems to hold out hopes of getting over this trouble. Control for the purpose of rapid manœuvre is, however, largely dependent on the overall dimensions of the machine. There is one point in this direction which is often overlooked. Effective manœuvre depends on the time which elapses between the event taking place which necessitates the manœuvre and its completion. The time necessary for the pilot to respond to the stimulus of the event is governed very largely by the comfort and convenience with which he can see what is going on. This actually has an important effect, and a favourable situation of the pilot in the manner possible on twin-engined aeroplanes greatly increases the real power of manœuvre.

Conclusion.—It is very obvious that there is no difficulty in finding technical work to do. Those difficulties which are confronting the development of the aeroplane can be attacked systematically apart from the question of general research. The new small aeroplanes which have recently been successfully flown seem to me to offer a most promising field for obtaining full scale results, enabling large aeroplanes to be flown in what is practically model form. If this is possible it should help considerably to accelerate our progress, for the aeroplane must be developed on the experimental flying field far more than it is at present, and at least as much as in the laboratory or the drawing office.

[In an appendix Mr. North dealt with the subject of the effect of the number of engines on reliability. The question is one of very considerable importance, and we therefore give this appendix below.]

Multiple Engine Aeroplanes and Reliability.—The chance of any engine failing may be taken as constant throughout and equal to $1/n$.

No. of engines.	Chance of a forced landing.
1	$1/n$
2	$1/n^2$
3	$(3n - 2)/n^3$
4	$(4n - 3)/n^4$

Hence, when half power will fly the aeroplane the two-engine arrangement is better than the three. When, however, more than half, but less than two-thirds, is required, the position is very different.

In the table below the machine with the number of engines given in the first column is better than the one with the numbers given at the top of each column for values of n greater than the number given.

No. of engines.	1	2	3
2	Always	—	—
3	2·00	Never	—
4	1·300	3·00	Always

Comparison of chances of forced landings for an aeroplane fitted with either two or three engines; flight being impossible with a single engine:—

No. of engines.	chances of forced landing.
2	$(2n - 1)/n^2$
3	$(3n - 2)/n^3$

E.g., when $n = 20$, *i.e.*, 95 per cent. engine reliability, the chances of a forced landing are roughly 1 in 10 for two-engine machine, and 1 in 140 for three-engine machine, therefore the three-engine machine is 14 times as reliable.

For $n = 100$ the three-engine machine is roughly 67 times as reliable as the twin.

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THE DEVELOPMENT OF COMMERCIAL AVIATION

BY F. HANDLEY PAGE AND W. P. SAVAGE

THE first part of this paper was devoted to statistics intended to show how the reliability of commercial air services has improved from the beginning of post-War civil aviation up to the present time. In a table showing the efficiency of the services, the very high figure of 97·2 per cent. is given, but the authors have fallen into the same error as does the Directorate of Civil Aviation, *i.e.*, the calculation of efficiency is based upon the proportion of number of flights completed to the number of flights attempted. As we have repeatedly pointed out in FLIGHT, figures founded upon this basis do not really give a true indication of the actual facts. They are of value from the point of view of showing that passengers may be reasonably certain that if their machine starts the flight will be completed. But they do not show the commercial reliability, which should, of course, be calculated on the proportion of completed to number of scheduled flights. We

fancy that if this were done a much lower percentage would be found.

On the question of petrol consumption the authors state that whereas in 1920-21 the average petrol consumption per flying hour was 25-26 gallons, the corresponding figure for 1922 was 20·2, and that at the present time this year's figure stands at 19·2. The improvement has been brought about, it is stated, by rigid inspection of the carburation system, by fitting smaller jets, and by careful tuning and frequent checking of float chamber levels.

In putting forward some suggested lines of development the authors state :—

" In the present state of air transport there is not sufficient traffic to justify large machines carrying, say, 16 or 20 passengers being used exclusively throughout the year, owing to the great difference in the amount of summer traffic as compared with that available in the winter months. This seasonal variation is not entirely due to the variation in traffic offering, but owing to the present impossibility of flying in fog or cloud, and the restricted hours of daylight during the winter. The statistics of the past few years show that the number of possible flights, and therefore the capacity to deal with the traffic offering, is very largely reduced.

"It is obvious, therefore, that our attention must for the present be largely concentrated on two types of unit : the small, single-engined machine, and the medium-sized machine with more than one engine. An operating company is therefore confronted with three alternatives in deciding upon the fleet to be used : one, the exclusive use of the single-engined machine ; two, the exclusive use of the medium-sized machine ; three, the use of both types.

" Each has its disadvantages. The first provides sufficient average accommodation during the winter, but not in summer, and it is then necessary to duplicate the service, thereby increasing the relative cost of operation, as against the cost of running a larger machine which would accommodate all the available load ; the second, while convenient during the summer, entails the running of the machines during the winter at a loss ; the third, if the company's operations are on a sufficiently large scale, appears to be the happy medium, allowing the use of the machines to the best advantage, to suit the varying amounts of traffic on different routes."

The paper also expresses the opinion that if future requirements demand a machine to carry 100 passengers, without doubt machines will be designed to carry that number.

On the question of aerodynamic improvement the paper continues :—

" The aerodynamical qualities of machines can be greatly improved with the existing knowledge which we have. At the present time the small machines termed motor gliders have as high a lift resistance ratio as 17, whereas the existing commercial aircraft rarely exceeds half this value. The effect of such an improvement upon the carrying capacity of commercial aircraft would be immense. For example, taking the twin-engined machine used on the London-Paris Service, it would result in a halving of the engine capacity and petrol consumption of the machine. Assuming that the new engines would weigh no more, it would result in a saving in weight of approximately 1,200 lbs. in the engine unit, and 500 to 600 lbs. in fuel. The fuel and oil bill would be cut in half and the load carrying capacity increased from 3,500 lbs. to 5,200 lbs.

" If we assume that our fuel and oil bill is one-quarter of the total, the cost per trip would be reduced to seven-eighths of the previous figure, and the cost per passenger at full load by 40 per cent.

" At the present time commercial aircraft carry 16 to 17 lbs. per horse-power total weight, of which about 25 per cent. is useful load, or 4 lbs. per horse-power. The improvement suggested would increase this figure to 8-10 lbs. per horse-power, at which commercial aviation assumes an entirely different aspect to the present-day conditions. The means by which such improvements are to be obtained lie outside the scope of this paper or of the Section of this Congress to which it is addressed. It may be briefly stated that it can be obtained by improvement in plane design, coupled with concurrent cleaning up of the fuselage and diminution of the body resistance."

When dealing with the subject of engine failure, the opinion is expressed that if the motive power is divided into two or more units, the probability of simultaneous failure of all units is very remote. Three-engined machines have been produced in France for some time, and regarding this division of the power unit the paper states :—

" The authors advocated some time ago the production of a three-engined machine, as if services are to be extended over difficult country or long stretches of water, it was felt that with the present-day engine neither a single nor twin engine machine would give the desired and required immunity from forced landings, which, if attended with no consequential damage to machine or injury to occupants, would create considerable loss of revenue owing to the machine being out of action, and also expense and time in the transport of a spare engine and the necessary labour. It is gratifying to see that the Air Ministry have now issued specifications for a three-engined machine, and it is felt that its production will bring within reach that 100 per cent. mechanical efficiency with its attendant benefits in almost every direction "

LONDON TERMINAL AERODROME

Monday evening, September 10

PASSENGER traffic is beginning to show a decline and is getting spasmodic again, but on the Paris and Berlin routes there is still plenty of traffic to keep all machines busy, and it is possible that the present spell of fine weather will again cause a revival to the largest summer proportions.

Owing to the increasing number of applications for seats on the Berlin route, and to the fact that when the fare for this line was fixed it was made at a particularly low rate in order to attract passengers—a policy which experience has shown was unnecessary—the Daimler Airway are increasing their fare from London to Berlin by 25 per cent. as from today. Even with this increase the fare to Berlin works out on the basis of *3d.* per mile, which is remarkably cheap considering the speed of air travel. At the same time, owing to the shorter hours of daylight, the stop at Bremen is being cut out, and the time for the entire journey is thus shortened appreciably. It is expected that even on the shortest winter days the machines will be able to get through to Berlin in a day by cutting out the stop at Hamburg, and taking the straight cross-country route from Amsterdam to Berlin.

On the London-Manchester route the evening machine from London to Manchester now leaves at 5.15 p.m. instead of 6.15 p.m. This also is owing to the shorter hours of daylight. When British summer-time gives place to Greenwich time next Sunday, the times will have to be altered again. In this connection I now learn that, for the time being, the idea of running the service to Manchester *via* Norwich has been abandoned, as there is not time to make this diversion, and, at the same time, make the times of departure of the machines convenient for the business men who use this line.

One of the Handley Page aeroplanes flying from Paris to London on Thursday developed slight engine trouble, and was forced to alight outside Boulogne. Mr. Wilcockson, who was piloting the machine, made a perfect landing, and his passengers—who were not even aware that anything unusual had occurred until the machine landed—travelled on to London by the slower boat and train methods.

The air specials between Amsterdam and Cologne, *via* London, have been even more numerous than usual owing to the further rapid decline in the value of the mark, and Lieut.-Col. Henderson has been very busy flying backwards and forwards from Croydon to Cologne with German passengers in the Surrey Flying Service's D.H.9.

Popularity of Aerial " Joy-Rides "

THE Surrey Flying Services are making the most of the fine weather, and Capt. Muir tells me that they are doing particularly well at Yarmouth with their joy-ride machines. The season at Southsea had to be cut short owing to the landing ground being required to be cut up into football pitches, but I understand that next year the Surrey Flying Services have secured the concession for joy-riding at Southsea. I am also informed that they have secured the sole flying rights at the Gloster fair ; in fact, the addition of aerial joy-rides now seems to be a settled institution at all the larger fairs where suitable alighting grounds can be arranged.

Goods traffic still continues to loom large in the general scheme of the K.L.M. and the Air Union, and no doubt this class of traffic will become increasingly important as the winter season approaches. The Instone Air Line, too, are finding that their goods traffic between London and Cologne is a paying proposition, and the " Vimy " still makes a journey in one direction or the other each day, being overhauled at night. In addition, whatever space there is available on the passenger machines is filled up each day with goods, so that their machines are always full between London and Cologne.

LIGHT 'PLANE AND GLIDER NOTES

THE various machines being built for the Sutherland and *Daily Mail* competitions are now beginning to take shape, and some of them are actually finished and ready for tests. If the weather is favourable during the next few days quite a number of light 'planes should be put through their preliminary flying tests.

* * *

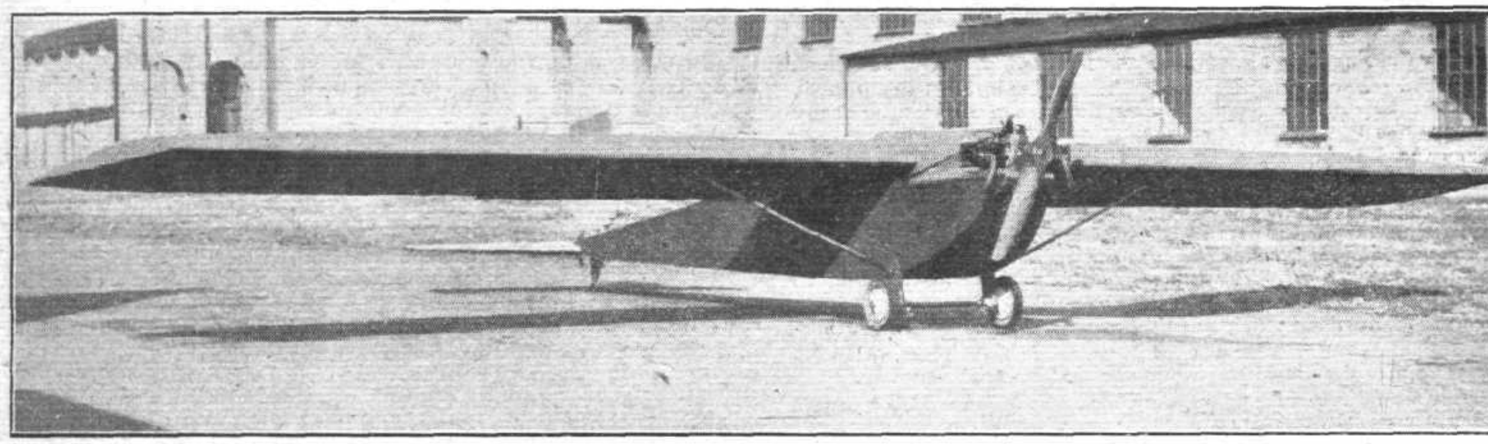
THE first of the Sayers-Handley Page machines has already been out for "rolling practice," as we used to say in the old days, but as the aerodrome is rather rough and the tail skid was damaged, little other than taxi-ing was done. Probably by the time this week's issue of FLIGHT is in the hands of our readers the machine will have been flown properly.

* * *

ON Saturday of last week (September 8) "Jimmy" James flew the A.N.E.C. light 'plane from Brooklands to Croydon and back, this being possible as this machine has received her airworthiness certificate and registration letters, and is thus a *pukka* civil aeroplane.

* * *

WHILE on the subject of the A.N.E.C. light 'plane, it may be mentioned that Raynham's mount for the competitions is now finished. This machine, which has been built by the Air Navigation and Engineering Company of Addlestone, Surrey, is also a monoplane, and is, as the accompanying photograph shows, practically a standard monoplane in miniature, with the pilot seated in a cut-out portion of the trailing edge. On a preliminary flight the machine behaved very well. The engine is a 500 c.c. Douglas.



RAYNHAM'S HANDASYDE LIGHT 'PLANE: This machine is fitted with a Douglas flat twin air-cooled engine.

* * *

THE first of the light 'planes designed and built by members of the Royal Aircraft Establishment Aero Club of Farnborough, was flown on Thursday of last week, September 6, by Capt. Bulman, who is chairman and chief pilot of the Club. This machine, known as the "Zephyr," differs from the usual run of light 'planes in that she is a pusher biplane with open tail booms. In fact, the machine is not unlike the old F.E., and it may be remembered that some months ago we suggested that the pusher type should be given consideration as offering certain advantages. For instance, the view is better than that which can be obtained in any tractor, and the absence of slipstream should make a slow-flying machine particularly comfortable. Aerodynamically it may be argued that the pusher is less efficient. That is probably true, but, on the other hand, that argument applies to the pusher as we knew it in the old days. It is not absolutely certain that something cannot be done to improve the efficiency while still retaining the desirable features of the pusher.

* * *

THE "Zephyr" is not to be regarded solely as a competition machine, as she is built very strongly, and is, in consequence, somewhat heavier than will be the majority of the machines competing at Lympne. Her total loaded weight is 635 lbs., which figure includes the weight of pilot (168 lbs.) and 3 gallons of petrol. For the competition a smaller quantity of fuel will, of course, be carried (1 gallon), and the weight in the competition will probably be reduced to less than 600 lbs.

* * *

THE "Zephyr" has a wing span of 29 ft. and a wing surface of 250 sq. ft. The chord is 4 ft. 6 ins. and the wing loading 2·54 lbs./sq. ft. The engine fitted is a 500 c.c. Douglas flat twin, rated at 3½ h.p., but developing probably something like 17 h.p. at 4,000 r.p.m. A two-bladed airscrew is fitted, and is driven by chain transmission at one-half of the engine speed. The diameter of the screw is 5 ft. The cruising speed is estimated at 45 m.p.h. and the landing speed at 28 m.p.h.

* * *

DURING the preliminary flying tests on Thursday last Capt. Bulman took the "Zephyr" off after a run of about 80 yards. It should be remarked that there was no wind at the time, and that against a head wind the take-off would, of course, be even shorter. The machine climbed fairly well, and the pilot flew around for about 15 minutes, doing sharp banked turns. He afterwards stated that the "Zephyr" was wonderfully controllable, and that he had full lateral control right down to the stalling speed. This is probably due to the efficient ailerons and large rudder area (the machine is fitted with two rudders).

* * *

THE "Zephyr," as well as a second machine being built and to be known as the "Hurricane," was designed by Mr. S. Childs to the specifications of the Club Committee, and the constructional work has been carried out entirely by members of the Club. Mr. P. N. G. Peters has been in charge of the woodwork, while Mr. F. N. Edney has looked after the metal fittings and rigging. The workmanship reflects the greatest credit on those who have spent all their spare time during the last four months or so on the construction of this machine.

As already mentioned, Capt. P. W. S. Bulman, M.C., A.F.C., is chairman of the Club and also chief pilot.

* * *

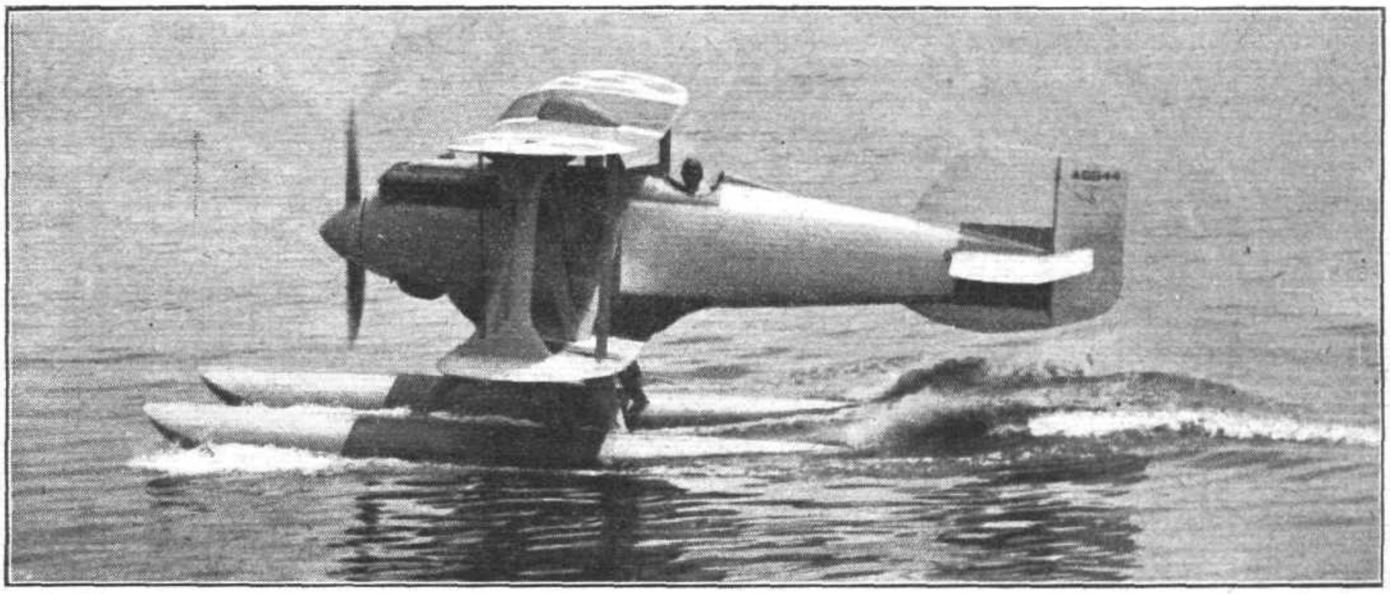
As the only aero club in the United Kingdom to design, construct and fly its own aircraft, the Aero Club of the Royal Aircraft Establishment is entitled to particular interest. The club was formed in October, 1922, and the programme for 1923 has included the building of two light 'planes. The "Zephyr" is already finished, and the "Hurricane," a cantilever monoplane with 500 c.c. Douglas, is now coming along. The latter machine has a much heavier wing loading, *i.e.*, 6 lbs./sq. ft., and will be very much faster than the "Zephyr." The fuselage is of triangular section, and an undercarriage of new type will be fitted.

* * *

WE compliment the R.A.E. Aero Club on their first machine, and on the enthusiasm which has enabled the Club to carry-on and to bring to completion the first of its two machines. At the same time we would express the hope that example thus set may be followed by others all over the Kingdom. In Germany there is scarcely a district without its aero club or aeronautical association, and the work being done by these is of extremely great value. Surely there is in this country sufficient enthusiasm to ensure the success of similar undertakings. A small beginning has already been made by the Light 'Plane Club of Addlestone, Surrey, and if others are interested we shall be pleased to open our columns to suggestions relating to the formation of other clubs. We understand that Mr. O. E. Simmonds, Hon. Sec. of the R.A.E. Aero Club of South Farnborough, Hants, will be pleased to give his advice, whether it be on financial or general matters. Mr. Simmonds was Hon. Sec. of the Cambridge University Aeronautical Society, and has had a large share in the success of the R.A.E. Aero Club, and should thus be well qualified to give advice.

THE SCHNEIDER CUP SEAPLANE RACE

The American team which will represent the United States of America in the forthcoming seaplane race for the Schneider Cup at Cowes on Friday, September 28, have now arrived in this country, and are installed at the Cowes works of S. E. Saunders, Ltd. The Americans have brought over four machines, two of which are of the Curtiss-Navy Racer type, C.R.-3, illustrated in Flight recently. These machines are numbered A-6080 and A-6081, and will be flown by Lieuts. Rutledge Irvine, U.S.N., and Lieut. D. Rittenhouse respectively. On tests recently one of these machines did 175·3 m.p.h. over a measured course. The third American machine is a Navy-Wright, N.W.-2, carrying the identification number A-6544. This machine, which will be piloted by Lieut. A. W. Gorton, is credited with having attained a speed of 177·5 m.p.h. in recent trials. By way of a stand-by the Americans have brought over a Curtiss-Navy seaplane, which has already been out for tests over the Solent. We understand that the floats were slightly damaged in hauling up the machine, and that the spare ones have been substituted. A lot of gear has been brought over, and the "expedition" filled one-fifth of the hold of the "Leviathan."



ANOTHER AMERICAN CHALLENGER: The Navy-Wright (N.W.-2) is to be piloted by Lieut. A. W. Gorton, U.S.N. The American machines have arrived, and are "stabled" at Saunders' of Cowes. The pilots will take every opportunity of getting in some flying practice, becoming familiar with the course, etc.

The machines are all very clean, as will be seen from the photograph of the N.W.-2 published herewith, and all are fitted with wing radiators. They are all float seaplanes, and if the weather is very calm will form formidable opponents. If, on the other hand, the sea should be fairly rough, it seems likely that the float type of machine may suffer in the navigability tests on Thursday, September 27. In the meantime the American pilots are getting in a lot of useful practice, becoming familiar with the course, practising alightings and get-offs, etc., and in that respect may be at an advantage compared with some of the other competitors.

The British team has been robbed of one of its members by the unfortunate accident to the Sopwith-Hawker machine last week. It appears that Lieut. Longton was out for a trial flight when the spinner blew off, as spinners have a habit of doing, and he had to alight in a very unsuitable spot. The machine turned over in landing, fortunately without injuring Lieut. Longton, and was completely smashed. This is extremely regrettable, not only because it robs the Hawker Engineering Company of their chance to fly in the great international race, but also because it reduces the British team to two representatives, the Supermarine "Sea Lion" flying boat and the Blackburn flying boat, also with Napier "Lion" engine.

The Supermarine machine is similar to that on which Capt. Biard won the race at Naples last year, and is a very fine machine indeed. It has been "cleaned up" since last year's model, and is now probably considerably faster than it was then. Seaworthiness has always been the chief aim of the Supermarine works, and in this respect the "Sea Lion" may be assumed to be up to usual Supermarine standard. If the day of the race should prove at all rough it is likely the Southampton boat will show to her best advantage.

The Blackburn "Pellet" is an unknown quantity as far as actual performance goes, although her lines look promising. The accompanying silhouette, taken from the Blackburn house organ, *The Olympian*, shows in some small measure the general arrangement of the "Pellet," which is a flying boat biplane, or rather *sesquiplan*, as the bottom plane is of less than half the area of the top plane. The wings are separated by V-struts, and the Napier "Lion" engine is mounted above the top plane. The machine is of the tractor type, and the pilot sits in front of the wings, in fact immediately ahead of the tractor screw. In the race the "Pellet" will be piloted by Mr. Kenworthy, the well-known Blackburn pilot.

Little is known about the French and Italian competitors. The former country has entered three machines and the latter two. The French team will probably include one Latham twin-engined machine and one C.A.M.S., although at the moment of writing no official information has been received from the French Aero Club. M. D. Lawrence Santoni, managing director of the latter firm, is almost sure to have a really fast machine in the race, and we look forward to seeing a C.A.M.S. competing side by side with our own machines in this classic contest. M. Santoni has many friends in this country from the old days when he was associated with the late Commander Porte in the British Deperdussin Company, and last year, it may be remembered, the C.A.M.S. was finished too late to take part in the race at Naples.

The Italians will probably be a Savoia and a Macchi,

THE "PELLET."

THE BLACKBURN SCHNEIDER CUP DEFENDER: A silhouette of the "Pellet" flying boat entered by the Blackburn Aeroplane and Motor Company, Ltd., which we reproduce from "The Olympian," the B.A.M.Co. house journal. The "Pellet" is fitted with a 450 h.p. Napier "Lion," mounted just above the top plane, the area of which is more than twice that of the bottom plane.

although here again great secrecy is being maintained. The competition promises some very fine flying, and, although the course is somewhat inaccessible, it is to be hoped that a great number of spectators will gather at Cowes and Southsea to watch the fight for the coveted Cup.

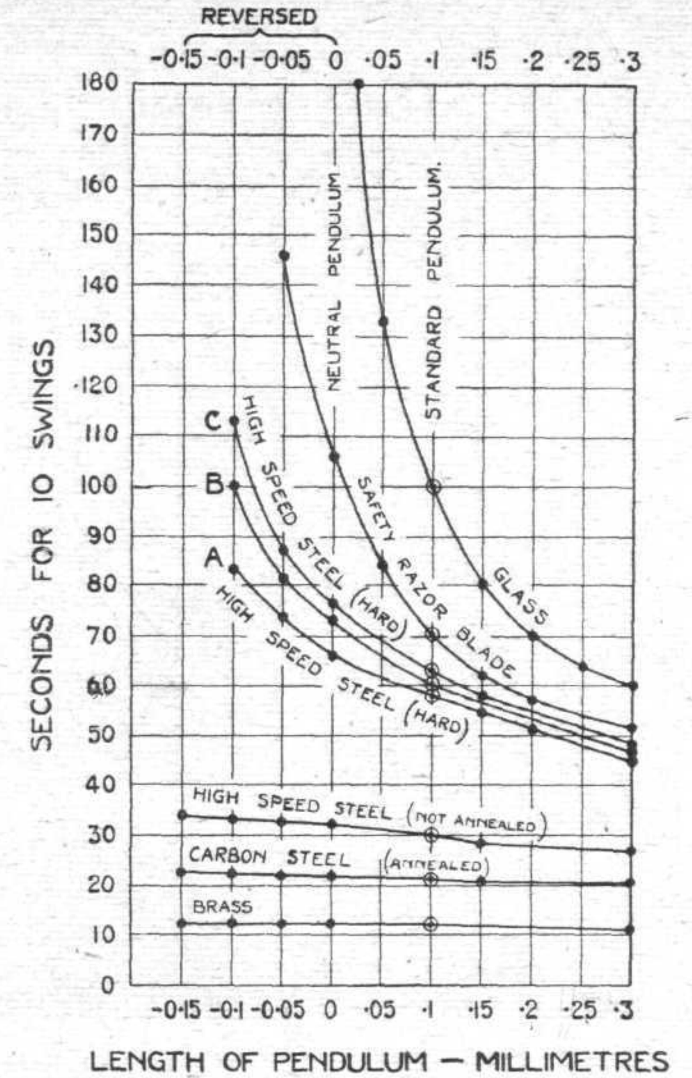
A PENDULUM HARDNESS TESTER

A NEW, and extremely ingenious, instrument for testing the hardness of materials, ranging from lead to sapphire, has recently been produced by the well-known makers of testing machines, etc., Messrs. Edward G. Herbert, Ltd., of Atlas Works, Levershulme, Manchester. This instrument, which is known as the Herbert Pendulum Hardness Tester, is very simple both in principle and in operation, and may briefly be described as consisting of a pendulum four-thousandths of an inch long, which is balanced on a ruby or steel ball of one millimeter diameter. When this pendulum is balanced on the substance to be tested, and is set swinging by a touch with a feather, it indicates the hardness of the surface on which it rests by the time of the swing, which is read by means of a stop watch. There is also another method of testing with this instrument, which will be referred to later. The complete instrument weighs 2 kgs., or 4 kgs., as required.

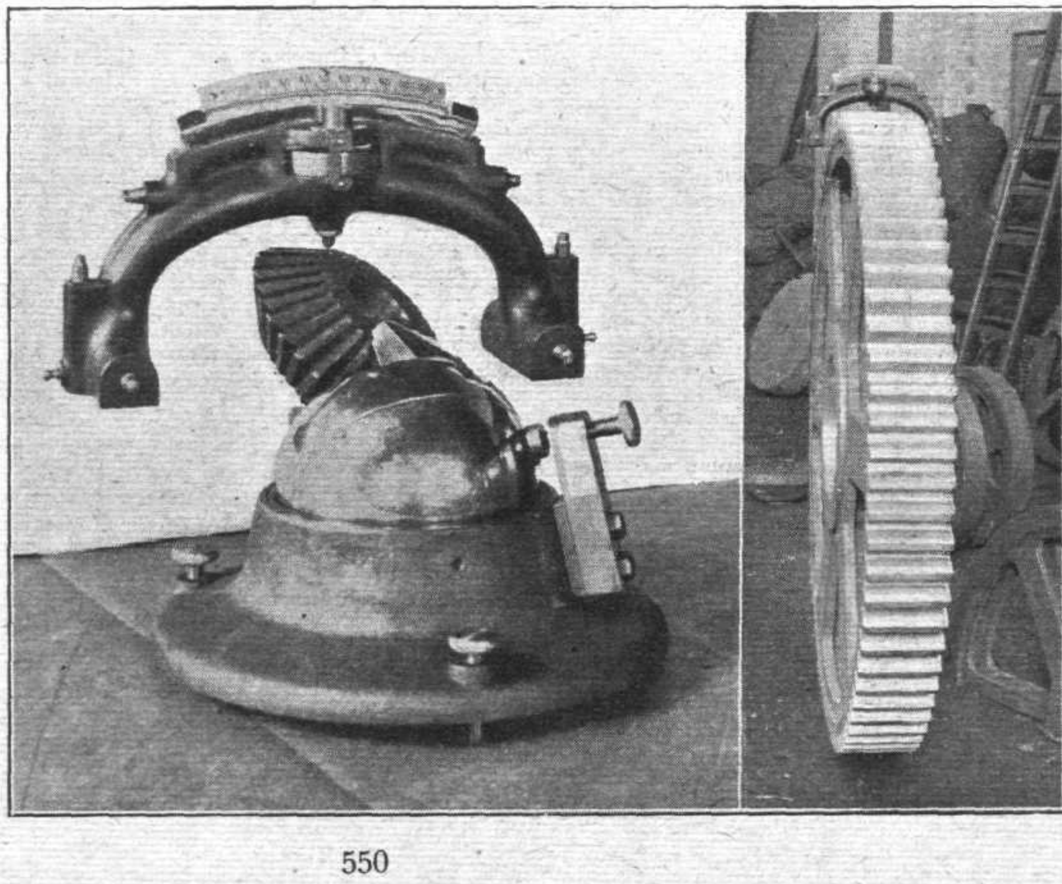
The principal advantages claimed for this instrument are as follows: It dispenses with all microscopic measurements and difficult readings, and, as it does not depend on impact, the readings are in no way affected by the mass or inertia of the specimen. Heavy loads are not used, and the test may be applied to thin and fragile articles without risk of breakage or defacement of the finished surfaces. Furthermore, the instrument is extremely simple and quick in operation, and being portable is very easily applied to almost any object in the workshop or the laboratory.

To describe the instrument more fully, it consists of a crescent-shaped casting at the inner centre of which is a steel or ruby, ball, one millimetre in diameter, held in a chuck, and six screwed weights are provided whereby the position of the centre of gravity of the whole instrument may be adjusted to coincide with the centre of the ball. Immediately above the ball is a graduated weight mounted on a screw. By raising or lowering this weight the centre of gravity of the instrument can be brought to a predetermined distance above or below the centre of the ball. The graduations on the weight show displacements of the centre of gravity in hundredths of a millimetre. A curved tube and bubble, with a scale graduated from 0 to 100, are mounted at the top of the instrument.

The centre of gravity being at the centre of the ball, the instrument is in neutral equilibrium when supported by the ball on a hard level surface. It tends to remain in any position in which it may be placed, whether upright or tilted at an angle. If the centre of gravity is above the centre of the ball the equilibrium may be unstable, in which case the instrument tends to lie down. If the centre of gravity is below the centre of the ball the equilibrium is stable. The instrument thus constitutes a pendulum oscillating about its central position, the time of oscillation being greater as the length of



THE HERBERT PENDULUM HARDNESS TESTER: Curves showing relation between length of pendulum and time of swing—time test.



The Herbert Pendulum Hardness Tester: On the left, testing a cutter, held in a special ball vice, and, on the right, testing a large gear wheel.

the pendulum—that is, the distance between the centre of gravity and the centre of the ball—is less. For standard tests the length of the pendulum is one-tenth of a millimetre (·0039 in.), and the time of a single swing on a very hard surface is 10 seconds.

The Pendulum Hardness Tester provides two entirely independent tests of hardness, which depend on different principles and measure different kinds of hardness. Each test has a scale of hardness numbers from 0 to 100, but the hardness numbers of a given substance are not the same on the two scales.

In one test, known as the Scale Test, the instrument is placed gently on the specimen in an upright position and then tilted to the right, until the bubble comes to 0 on the scale, and then released. The weight of the instrument causes the ball to indent the surface, and the effect of tilting to 0 is to elongate the indentation. When the pendulum is released the ball rolls back along the grove so formed, pushing a little wave of material in front of it until its energy is exhausted and it stops, the position of the bubble indicating the "scale hardness number" of the specimen.

The second test is known as the Time Test, and in this the pendulum is placed gently on the specimen with the bubble at or near 50, and is caused to oscillate through a small arc. As the suspension is extremely delicate it is best to set the pendulum swinging by a touch with a feather. The time for one or more swings is taken by means of a stop watch. In most cases it is sufficient to time a single or double swing, but on soft substances which produce rapid oscillations, and for very accurate readings, the time for ten swings is taken. The time period of oscillation of the pendulum is a very reliable measure of the hardness of the surface on which it rests, and the time in seconds taken in making ten single swings on any substance is the "time hardness number" of that substance. Thus the time taken in making ten swings on glass is 100 seconds, on hardened steels 50 to 85 seconds, on lead 3 seconds etc.

Some typical Scale and Time Test readings on various materials, using 1 millimetre steel ball, are given in the following table :—

Material.	Scale.	Time.
Glass	97	100
Very hard carbon steel	93	75
Hard carbon steel	88	65
Tempered H.S. steel	75	52
Annealed H.S. steel	54	26
Annealed carbon steel	41	22
Rolled brass	14	15
Cast brass (soft)	4	11
Lead	0	3

On hard substances, such as hardened steel, the effects of shortening the pendulum to zero and reversing it are progressively: to lengthen the time of swing (*i.e.*, raise the "time hardness number"); to render the pendulum much more sensitive to small differences of hardness; and to increase the numerical difference between the hardness numbers of specimens of almost equal hardness. The reversed pendulum demands careful manipulation and perfectly prepared specimens, but provides an exceptionally sensitive method of investigating minute differences of hardness.

A useful empirical relationship between the Time Test Scale and the Brinell Hardness Scale has been established experimentally. Briefly it is thus: for Time Test figures below $33\frac{1}{3}$ the Brinell number is $\cdot 3T^2$; for numbers over $33\frac{1}{3}$ it is $10T$. It will be observed that $10T = \cdot 3T^2$ when $T = 33\frac{1}{3}$.

The Institution of Aeronautical Engineers

Fixtures for 1924

Jan. 11.—Paper: "Reminiscences of the Early Days of Aviation at Brooklands," by Mr. R. L. Howard-Flanders, A.M.I.Mech.E., A.F.R.Ae.S., Honours Member and Honorary Secretary of the Institution. 6.30 p.m., Engineers' Club.

Jan. 25.—Paper: "Some Problems in Connection with the Structure of Rigid Airships," by Lieut.-Col. V. C. Richmond, O.B.E., B.Sc., etc. 6.30 p.m., Engineers' Club.

Feb. 8.—Paper: "Aeroplane Performance Estimates," by Mr. R. C. Chadwick. 6.30 p.m., Engineers' Club.

Feb. 22.—Paper: "Low-Powered Flying," by Mr. W. O. Manning, A.F.R.Ae.S., Honours Member. 6.30 p.m., Engineers' Club.

March 7.—Paper: "Braided Rubber Shock Absorber Cord for Aircraft," by Mr. L. Rowland. 6.30 p.m., Engineers' Club.

March 20.—Annual Meeting. Details will be announced in due course.

March 26.—Visit to the works of Messrs. S. Smith and Sons (M.A.), Ltd., Cricklewood. 3 p.m.

April 11.—Paper: "Radial Engines for Aircraft," by Mr. S. M. Viale, Honours Member. 6.30 p.m., Engineers' Club.

April 23.—Visit to the National Physical Laboratory, Teddington. 3 p.m.

May 9.—Paper: "Some Possible Future Developments in Aeronautics," by Capt. W. H. Sayers, Honours Member.

May 21.—Visit to the Instone Air Line, Croydon. 3 p.m.

Note.—Members of the Institution become Honorary Members (*pro tem.*) of the Engineers' Club on the night of the lectures, and as such may use the public rooms and obtain refreshments, etc. Light refreshments will be available in the lecture hall.

The Königsberg-Moscow Air-Line

THE company running the air-line Königsberg-Moscow with the Fokker F.III commercial monoplane publish comparative statistics from May 1 to August 1, 1922 and 1923. The percentage of reliability for the period in 1923 was 100. On June 8, 4,800 kms. were flown with only four machines.

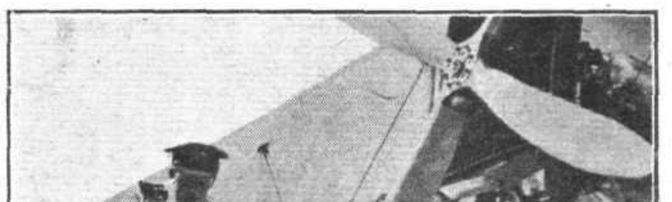
Year.	Period.	No. of flights.	Kms.	No. of pass.	Weight of freight, kgs.
1922 ..	1.5-1.8	151	98,470	387	12,407·92
1923 ..	,,	204	102,390	415	25,250·00

The Portuguese Around the World Flight

AFTER making a tour of inspection of various aircraft firms in England and France, the Portuguese pilot, Sacadura Cabral, has finally decided to have a Fokker F.III W seaplane for his forthcoming flight round the world. It will be recalled that on his last attempt he used a Fairey seaplane, and it was hoped that he would again employ this successful type of machine on this present occasion.

Our Air Mail Stamps

Is the dawn of the British air mail stamp approaching? We are glad to see in the daily press certain efforts to stir up public opinion in favour of an appeal—voiced for many a year in the columns of FLIGHT—for an air stamp for this country. One such advocate is Brig.-General R. Ridgway, President, Aero Philatelic Club, who, writing in *The Times*, emphasises the point that our air mail services need greater publicity—propaganda—to make them popular. So why not special air stamps, for these in themselves would form excellent propaganda?



A Supermarine "Seagull Amphibian, with Napier "Lion" Engine, at the Naval Base at Tokio: This photograph shows, standing up, Colonel the Master of Sempill, who was originally in charge of the British Aviation Mission to Japan, and, in the cockpit, Major Brackley, who took charge last year. Major Brackley is reported to have been on his way to England at the time of the terrible earthquake. All members of the British Aviation Mission are now reported to be safe.

CELASTOID AND CELANESE

To obtain a substance which has all the good qualities of celluloid for all its numerous purposes, and others in addition, and yet with none of the disadvantages and drawbacks of the inflammable material is an achievement which is worth recording.

The British Cellulose and Chemical Manufacturing Company, Ltd., who have a wonderful up-to-date plant covering many acres at Spondon, Derby, were occupied during the War in the manufacture of cellulose for the numerous war purposes for which this product is a necessity. Vast quantities were required not only for the manufacture of explosives, but also for the making of the dope required for use in connection with aircraft.

Before the War the bulk of the cellulose used for dope came to England from Germany, and, naturally, this supply was stopped as soon as war was declared.

Fortunately the British Government were able to get into touch with two Swiss scientists, Dr. C. Dreyfus and Dr. H. Dreyfus, who were amongst the leading experts in the production of cellulose acetate. The services of these gentlemen were acquired, and the British Cellulose and Chemical Manufacturing Company, Ltd., was able to produce cellulose acetate and its various solvents under their expert direction.

The huge demand for dope for the air services kept the company employed at full pressure, and necessitated the rapid enlargement of the works, with a big plant and organisation. When the demand fell off—as it naturally did on the cessation of hostilities—the firm were faced with the problem of turning the fine equipment of the factory, and the great experience gained, to the arts of peace.

It was then that the scientific knowledge of the firm's experts came to the rescue, and the company is now manufacturing a wonderful artificial yarn known as Celanese, which has for its base cotton, but which when manufactured has all the properties of silk, with the added advantage of being immune from rotting or the effects of wet and weather.

We recently had the opportunity of examining some of the beautiful woven materials which are made from the " yarn "—a term which, for the want of a better, we must use in this connection.

This material is, of course, suitable for all purposes where a silk fabric can be used, and as far as aircraft are concerned Celanese can be employed to advantage for the interior fittings, such as curtains, blinds, etc., of the cabins of commercial 'planes—in this respect it is particularly suitable for motor and other coach work. Manufactured in a great variety of shades and colours and watered finishes, this Celanese is remarkably beautiful and is practically fireproof, while its wearing qualities and capabilities for cleaning make it particularly suitable for carriage furnishing.

But perhaps of more importance and interest from the point of view of the aircraft and motor-car designer is another remarkable product of the company known as " Celastoid." It is in effect a safety celluloid, for it has all the properties of celluloid as we know it, while being non-inflammable. This fact makes it of particular value in its numerous applications for use in aircraft and motor vehicles.

The new material is non-porous and non-hygroscopic. The latter feature has been demonstrated by the immersion of the Celastoid for long periods in water when, on removal, its specific gravity has been found not to have increased at all. It is a perfect electric insulator, and can be moulded in any form and easily worked on machines, such as lathes, presses, stamps, etc., and can be drilled, turned, tapped, etc., and takes a high polish.

Supplied in sheets highly polished, it can be used in the manufacture of all kinds of utility and artistic objects, and can be coloured to exactly represent horn, coral, marble, amber, tortoiseshell, ivory, ebony, etc., and in all colours and patterns.

In its transparent form for side curtains and windscreens it gives a pure transparent window substance which is immune from the dangers of fracture and splintering and proof against fire risks. In comparing it with other substances which have from time to time been introduced for these purposes, it is well to bear in mind that the new material is practically as white and clear as glass and will remain so, while it does not suffer from spotting in rain, which has been a disadvantage of some other glass and window substitutes. It can be supplied in sheets up to 3 mm. thick, and will soon be available in thicker, and therefore stronger, sheets.

The standard size of the sheets manufactured by the company is 50 ins. by 20 ins., and the weight may be estimated from the fact that one sheet of 20/1,000ths of an inch thick weighs 1 lb. The sheets are sent out highly polished on both sides, but can be supplied with a matt surface on one or both sides. The material can also be supplied in the form of tubes for such purposes as the leads of ignition and electrical appliances.

As an insulator we may mention that Celastoid is practically electrically perfect. The breakdown test is in the neighbourhood of 720,000 volts per cm., and it can be used for high-tension condensers and for switch-boards and bases of electrical instruments. In addition to being easy to work in the ordinary manufacturing machinery, it can be welded with a special solution known as the S.D.I. solution, which the firm manufacture and supply.

The uses of the material are almost indefinitely extended. One could fill columns detailing its applications.

The company have offices at 8, Waterloo Place, London, S.W 1, from which address all particulars can be obtained, and where we were privileged to examine, and have explained to us, many of the very interesting applications of the new material.

AERONAUTICS AT THE NORTHAMPTON POLYTECHNIC (LONDON)

IN the Educational Announcements for the session 1923-24 (evening) of the Northampton Polytechnic Institute, St. John Street, London, E.C., just published, we note a very comprehensive series of courses in aeronautical engineering. To those students, or others, who contemplate entering this important branch of engineering we suggest that they apply at once for the announcements referred to, which set forth very fully the various courses provided at this Institute, to which only a brief reference to the aeronautical section can be made here.

It is stated in this " Official Guide " that the great importance, both from a national and an engineering standpoint, of the subject of " Aeronautics " is now fully recognised, and the full sessional course of instruction in " Aeronautical Engineering," which was first given in the session 1909-10, will be continued in the session 1923-24, with such improvements and additions in matters of detail as the great developments made during the War have shown to be desirable. The course is not in any sense a popular treatment of the subject, but deals with the science and practice of aviation as a special branch of modern engineering, the results of modern research being dealt with in lectures, drawing office and laboratories. Further, it is hoped that new information will result from investigations in the laboratories, which have been specially equipped for that purpose.

The object of the course is to train, in the special problems which have to be faced in the development of this industry, those *who already have the necessary preliminary knowledge*. Admission to these classes will, therefore, be limited to those who have had some previous engineering training. The full courses consist of : (*a*) Special Aeronautical Lecture ; (*b*) Aeronautical Drawing-Office Work and Design Work ; (*c*) Aeronautical Laboratory ; (*d*) Mathematics Classes (as required).

The aeronautical laboratory is equipped with an uncovered aeroplane, showing detail construction, with a wind channel, water channel, apparatus for testing airscrews, and with testing machines for determining the elasticity, strength and hardness of materials, and their suitability for the purposes for which they are intended, and other experiments.

In (*a*) the lectures are in three sections : I. General Aeronautics (Principles and Machines), including the theory of aerodynamics, materials of construction, assembling, seaplanes, dirigibles, accidents, military and commercial aviation, etc. ; II. Airscrews ; III. Aero Engines.

The work done in (*b*), the Drawing and Design Classes, will depend on the standard already attained by the individual students, but advanced students will be able to deal with practical problems in the design of the main components of an aeroplane.

It is obvious that a knowledge of mathematics (section (*d*)) is extremely important to students who desire to make rapid progress in such a subject as aeronautics. What is wanted, however, is a sound mathematical training upon which the special work can be built, and this is already provided in the ordinary calculations classes, held at the Institute.

THE ROYAL AIR FORCE

London Gazette, September 4, 1923

General Duties Branch

Flying Offr. L. Hamilton, M.B.E., D.F.C., is granted perm. commn.; Sept. 5. The following are granted short service commns. as Flying Offrs., with effect from, and with seny. of, Aug. 22 :—C. H. A. Farnan, S. J. Stocks. Lieut. C. E. Bowden, R.A,S.C., is granted a temp. commn. as Flying Offr. on secdg. for four years' duty with R.A.F.; Aug. 23. Flight Lieut. F. H. Laurence, M.C., is placed on half-pay, Scale B; Sept. 1. Flying Offr. S. E. Sutcliffe is transferred to Res., Class A; Sept. 2. The following Flight Lieuts. resign their perm. commns. :—C. G. Mathew; Sept. 1. R. T. Nevill; Aug. 25.

Stores Branch

The following Flying Offrs. are transferred from Gen. Duties Branch to Stores Branch. Their names will be placed at the bottom of gradation list of Flying Offrs. :—R. Lamb, A. J. Redman, D.F.C.; April 30. L. J. V. Bates; May 1. A. J. Cox, M.B.E.; May 2. Flight Lieut. P. J. Murphy is apptd. actg. Sqdn. Leader, with pay and allces. of that rank; Oct. 1, 1922. Wing Cdr. W. J. D. Pryce, O.B.E., D.C.M. (Qrmr. and Capt., Extra-Regtl. List) relinquishes his temp. commn. on retirement from Army, and is granted rank of Lieut.-Col., R.A.F.; Sept. 1.

Chaplains' Branch

The Rev. P. T. Hutchison resigns his short service commn.; Sept. 1.

Reserve of Air Force Officers

Class A.—The following are granted commns. on probn. in General Duties Branch in ranks stated, with effect from dates indicated :—*Flying Offrs.*—W. H. Farrow, D.F.C.; Sept. 4. A. S. Poynton; Aug. 22. C. E. C. Rabagliati, M.C., A.F.C.; Sept. 4. *Pilot Offr.*—R. T. Bark; Aug. 27.

Class B.—Flight Lieut. R. T. Nevill is granted a commn. in rank stated; Aug. 25. Flying Offr. C. E. V. Graham, M.C., is transfd. from Class A to Class B; Aug. 2.

Class C.—Flight Lieut. C. G. Mathew is granted a commn. in rank stated; Sept. 1. Pilot Offr. J. T. Newton is transfd. from Class A to Class C; July 24.

Nursing Service

The following are confirmed in their appts. as Staff Nurses :—Miss M. B. Charlesworth; Jan. 6. Miss M. E. Ball; Jan. 15. Miss E. M. Burton; Feb. 3. Miss M. Simpson; Feb. 8.

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the R.A.F. are notified :—

General Duties Branch

Air Commodore C. L. Lambe, C.B., C.M.G., D.S.O., to half-pay list. 4.9.23.

Squadron Leader J. O. Archer, C.B.E., to School of Army Co-operation, Old Sarum. 1.9.23.

Flight Lieutenants: E. T. Carpenter, A.F.C., to Electrical and Wireless School, Flowerdown. 1.9.23. D. Cloete, M.C., A.F.C., to Central Flying School, Upavon. 10.9.23. E. B. C. Betts, D.S.C., D.F.C., to Headquarters, Inland Area. 17.9.23. A. F. Lang, M.B.E., to No. 10 Group Headquarters, Lee-on-Solent. 7.9.23. V. M. Kenny-Leveck, M.B.E., to R.A.F. Depot. 1.9.23, on appointment to a short service commn. pending embarkation overseas.

Flying Officers: J. G. Western, M.B.E., to School of Army Co-operation, Old Sarum. 10.9.23. C. D. Spiers, to No. 12 Sqdn., Northolt. 7.9.23. L. F. Wilson, to R.A.F. Depot. 30.8.23, on appointment to a short service commn. R. Duncanson, to R.A.F. Depot. 31.8.23, on appointment to a short service commn. W. N. Plenderleith, to R.A.F. Depot. 16.8.23, pending disposal on transfer to Home Establishment. E. V. Culverwell, to R.A.F. Depot. 1.9.23, for course of instruction.

Pilot Officers: J. S. Phillips, A. M. Rowe, and W. H. Ryder, all to No. 7 Sqdn., Bircham Newton. 15.9.23, to course of instruction. T. A. Verney-Cave, to No. 2 Flying Training School, Duxford. 31.8.23, for further instruction.

Medical Branch

Flight Lieutenant (Medical) J. J. Walsh, to No. 7 Sqdn., Bircham Newton. 28.8.23.

Flying Officer (Q.Mstr. Medical) W. King, to R.A.F. Hospital, Cranwell. 9.8.23, on appointment to a permanent commn.

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NOTICES TO AIRMEN

Germany: Netherlands-German Aerial Corridor—Nordhorn Emergency Landing Ground

IT is hereby notified :—

1. *Netherlands-German Aerial Corridor.*

As the result of a recent agreement between the Netherlands and German Governments, the point of crossing the Netherlands-German frontier for aircraft flying between Amsterdam and Bremen has been defined as the point at which this frontier is cut by the Almelo-Nordhorn canal.

The position of this point is 4 km. S.S.W. of Nordhorn, and 13 km. N.W. by N. of Bentheim—lat. 52° 24′ N., long. 7° 04′ E.

2. *Nordhorn (Gut Klausheide) Emergency Landing Ground* is now available for landing.

Position.—Lat. 52° 26′ N. long. 7° 10′ E. Situated approximately 6 km. E. of Nordhorn and 15 km. N. of Bentheim.

Dimensions for Landing.—700 by 500 metres.

Markings.—A white circle 10 metres in diameter is marked in the centre of the ground.

(No. 65 of 1923.)

Biggin Hill: Night Flying

NIGHT flying is carried out from Biggin Hill Aerodrome, and in this connection searchlights are operated in the area bounded by West Wickham, Warlingham, Tatsfield Aerial Lighthouse, Westerham, Knockholt and Farnborough (Kent).

Aircraft flying below 4,000 feet display navigation lights, but above this height they may not do so.

(No. 66 of 1923.)

Great Britain

DANGER Zones at Okehampton, Redesdale, Salisbury Plain and Trawsfynydd (with charts).

(No. 68 of 1923.)

France: Abbeville—Cloud, Visibility and Weather Signals.

1. A SYSTEM of ground signals to denote to pilots the height of clouds, visibility and weather at St. Inglevert and Beauvais was brought into operation at the Abbeville aerodrome on August 1, 1923.

2. The signals consist of two groups, one referring to St. Inglevert, prefixed by the letter "S," and the other to Beauvais, prefixed by the letter "B."

3. This letter is followed by three panels generally bearing a number of red diamond-shaped marks, arranged as on a playing card, which panels indicate respectively :—

(i) the height of the lowest cloud;
(ii) the visibility; and
(iii) the weather.

4. The significance of the panels is as follows :—

No. of Marks. (*a*) *Height of Cloud.*

0	means cloud below	50	metres	=	150	feet approx.
1	,, ,,	100	,,	=	300	,,
2	,, ,,	200	,,	=	600	,,
3	,, ,,	300	,,	=	1,000	,,
4	,, ,,	600	,,	=	2,000	,,
5	,, ,,	1,000	,,	=	3,300	,,
6	,, ,,	1,500	,,	=	4,900	,,
7	,, ,,	2,000	,,	=	6,600	,,
8	,, ,,	2,500	,,	=	8,200	,,

9 means no low cloud.
3 in line means no observation.

(*b*) *Visibility.*

0	means visibility less than	50	metres	=	50 yds.	approx.
1	,, ,,	200	,,	=	220 yards	,,
2	,, ,,	500	,,	=	550 ,,	,,
3	,, ,,	1,000	,,	=	1,100 ,,	,,
4	,, ,,	2,000	,,	=	1¼ miles	,,
5	,, ,,	4,000	,,	=	2½ ,,	,,
6	,, ,,	10,000	,,	=	6 ,,	,,
7	,, ,,	20,000	,,	=	12 ,,	,,
8	,, ,,	50,000	,,	=	31 ,,	,,
9	means visibility above	50,000	,,	=	31 ,,	,,

3 in line means no observation.

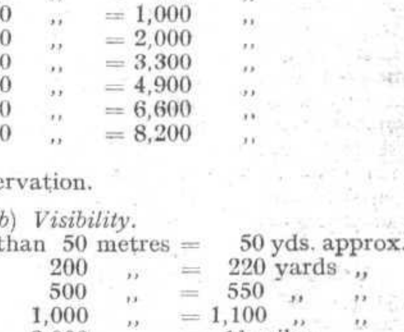
(*c*) *Weather.*—0 means fine or clear sky, 1 cloudy or overcast, 2 fog, 3 showers, 4 drizzle, 5 rain, 6 snow (or snow and hail), 7 sleet (or rain and snow), 8 hail (or rain and hail), 9 thunderstorm, 3 in line means no observation.

5. Each panel consists of a rectangular area of white, distinct from the surface of the aerodrome, and measuring 6 m. by 9 m. A space, 3 m. wide, is left between adjacent panels.

6. A typical signal would be :—

Indicating—St. Inglevert: Height of cloud, 2,000–3,300 ft.; visibility, 6–12 miles; weather, showery.

Beauvais: Height of cloud, no observation; visibility, 6–12 miles; weather, fine.



7. The signals are situated on the west side of the aerodrome, to the south-east of the buildings.

(No. 67 of 1923.)

By Douglas B. Armstrong

British Air Stamp Essays

With each extension of the British air mail service, the need for a particular air post stamp becomes the more pressing. Germany and Switzerland, whence the latest lines extend, both provide stamps of a distinctive nature for use on airborne correspondence. The postal authorities in this country complain of the public apathy with regard to the air post, yet they refrain from adopting the most effective form of propaganda that a British air stamp would supply. It may be, however, that we are at last within sight of this consummation "most devoutly to be wished" for, according to the *Postage Stamp*, designs for such a stamp were recently submitted by Bradbury, Wilkinson and Co., the eminent stamp engravers. The Director of Civil Aviation has long been in favour of the issue of such a stamp, and in this he is supported by Colonel Moore-Brabazon, Chairman of the Post Office Committee on the Air Mail Service. The British Post Office took over fifty years to decide upon the introduction of "postage due" stamps, so that there is a prospect that in course of time some enlightened Postmaster-General may yet concede the principle of a special air post stamp.

America's New Air Stamps

The United States Post Office Department was the first to introduce air post stamps of a definitive type in connection with the service inaugurated between New York, Philadelphia-Washington in May, 1918. As the supplementary charge upon aerial letters was reduced, so the face value of this stamp was brought down from 24 to 16 cents in July, 1918, and again to 6 cents in December of that year. Finally, when it was found possible to carry air mails at the ordinary 2 cents rate of postage, the use of special stamps was suspended.

Now they are to be revived on account of further developments in the air mail service, including a special night flying service from New York to San Francisco. The new U.S. air stamps will be issued almost immediately in denominations of 10-12 cents, 12-18 cents and 18-26 cents, the air fees varying according to distance.

Air Stamps at Auction

Values of air stamps and covers are soaring. Some notable prices were realised at a recent London auction by scarce varieties, which a few years ago would have been considered as negligible. The highest bid was £35 for a flown cover bearing the 1 c., 2 c. and 3 c. stamps of the United States, postmarked "London, R.34, 13th July, 19," being one of those carried by the famous airship on its return voyage across the Atlantic. The number of letters carried on this trip was extremely limited, and it is undoubtedly one of the rarest air post souvenirs. No distinguishing cancellation was applied to letters carried on the outward journey.

At the same sale a set of the very primitive and seldom-met-with private air post stamps issued by the Compagnie des Transports Aériens Guyanais, which operates the semi-official air mail service between Cayenne and St. Laurient in French Guiana, sold for £16, whilst £10 was paid for an error of the 3 pesos Colombia with double overprint "G.B.", of which only four copies are said to exist.

A flown cover of the first Swiss air post between Burgedorf and Bern, postmarked "30.III.13," was knocked down for £7, and one of the Basle-Liestal service for £5, both bearing the special souvenir stamps issued.

One of the covers carried on the trial flight between Rabal and Casablanca in Morocco, organised by *Le Petit Journal* on September 13, 1911, fetched £5 10*s*. There were fifteen lots of air stamps, etc., all of which sold for good prices.

Readers are invited to forward to the Editor of FLIGHT *letters, etc., bearing aerial stamps or postmarks for mention in this column, as well as out-of-the-way varieties, etc.*

We shall also be pleased to hear from correspondents interested in air-stamp collecting, and to answer any queries.

SOCIETY OF MODEL AERONAUTICAL ENGINEERS
(London Aero Models Association)

ON Saturday last one of the largest meetings of the season was held at Sudbury, members coming from all parts to compete for the Paddington and District Model Aeroplane Club's Challenge Cup, also *Model Engineer's* Cups No. 1 and No. 2. The Judges for the competitions were Messrs. Felix Kelly and M. Levy.

The *Model Engineer's* No. 2 Cup was won by Mr. D. A. Pavely, C. Hersom second, and B. K. Johnson third. Mr. Pavely's model was driven by compressed air, his best performances being 52, 52, and 53·8 secs.; Mr. Hersom, 31·2, 32·4, and 39·2 secs., his machine being an enclosed fuselage tractor. Mr. B. K. Johnson's model was a spar tractor, and his best times were 50·2, 37·4 and 44 secs.

The Paddington Cup was won by Mr. Hersom, who gained 64 points, Mr. B. K. Johnson being second. There were also two records put up, Mr. Hersom's enclosed fuselage tractor making the record for R.O.G., 34 secs.

Enclosed fuselage glider record was improved by Mr. Howes, whose model put up a performance of 40·4 secs.

The attempts on the glider record of the following morning were keenly competed for, but no records were broken. Mr. F. de P. Green did some excellent glides with his enclosed fuselage glider, his best performance being 31·4 secs.

A. E. JONES, Hon. Sec.

PUBLICATIONS RECEIVED.

U.S. National Advisory Committee for Aeronautics. Technical Notes. No. 141.—Experiments with a Built-in or Fuselage Radiator. By C. Wieselsberger. May, 1923. No. 142.—Adaptation of Aeronautical Engines to High Altitude Flying. By K. Kutzbach. May, 1923. No. 143.—Calculations for a Single-Strut Biplane with Reference to the Tensions in the Wing Bracing. By O. Blumenthal. June, 1923. No. 144.—Notes on the Design of Ailerons. By W. S. Diehl. June, 1923. No. 145.—Aeronautical Instruments. By K. Bennewitz. June, 1923. No. 147.—Speed Measurements made by Division "A" of the Airplane Directorate. By V. Heidelberg and A. Holzel. July, 1923. No. 149.—Influences in the Selection of a Cycle for Small High-Speed Engines. By R. Matthews. July, 1923. National Advisory Committee for Aeronautics, Washington, D.C., U.S.A.

AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: cyl. = cylinder; I.C. = internal combustion; m. = motor

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

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